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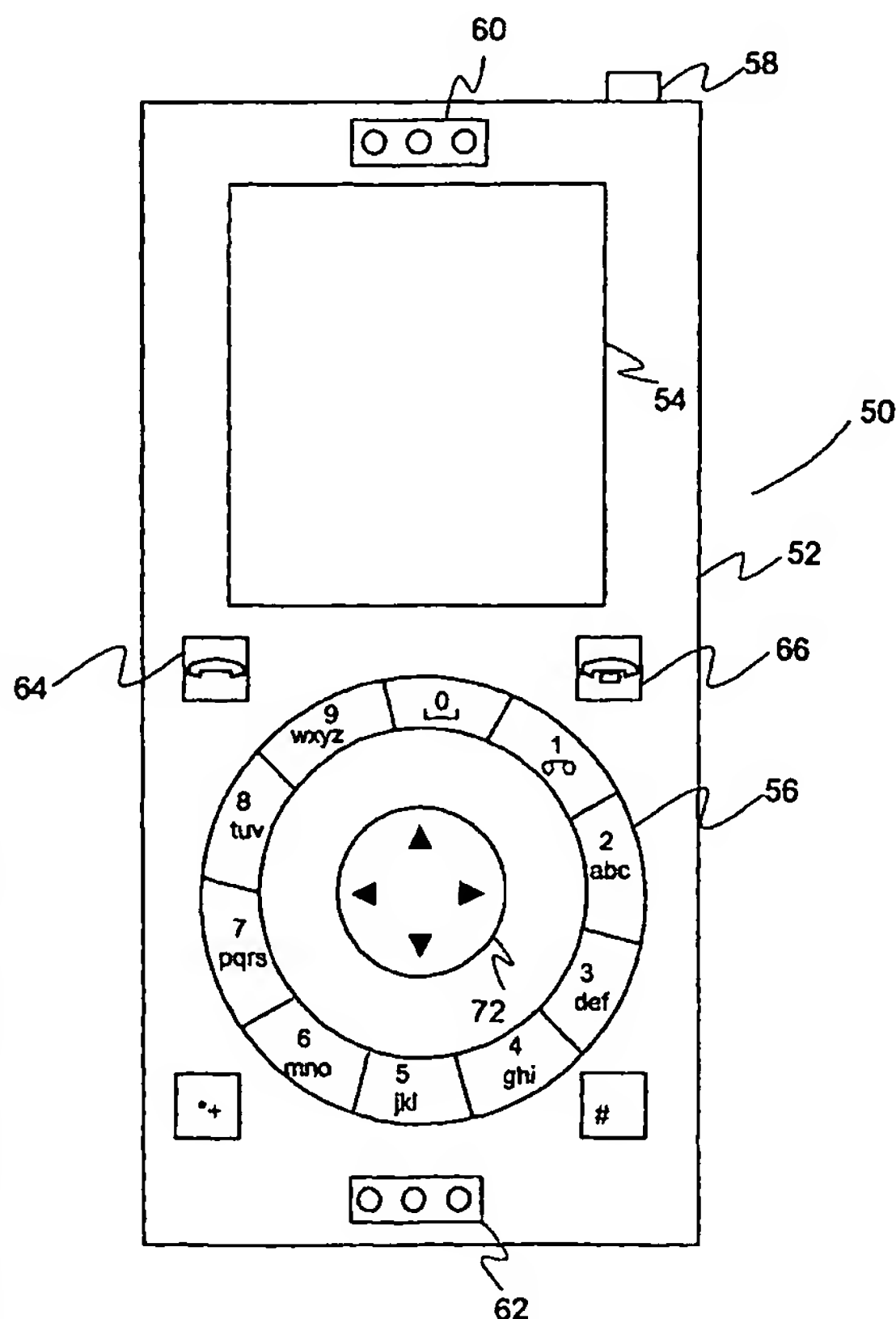
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(54) Title: KEYPADS FOR ELECTRICAL DEVICES



(57) Abstract: A mobile telephone (50) comprises a body (52), a display (54) and a keypad (56). The keypad has a plurality of individual numeral keys assigned to individual numerals and is rotatable with respect to the body. In this way it is possible for the display to remain in a fixed orientation with respect to a user whilst the body is rotated about the display so that the mobile telephone can be converted from right-handed to left-handed use or so that the orientation of the display can be moved from a first orientation to a second orientation.

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KEYPADS FOR ELECTRICAL DEVICES

FIELD OF THE INVENTION

- 5 This invention relates to keypads for electrical devices and is particularly, but not exclusively, related to keypads for mobile or portable devices, such as mobile telephones.

BACKGROUND OF THE INVENTION

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In order for mobile telephones to be conveniently usable, they are of a relatively small size. Accordingly, the keypads of such devices are also small. This is particularly the case since, not only are smaller and smaller mobile telephones being manufactured, but it is becoming desirable to have larger and larger displays on
15 such devices which means that there is less and less space available on which to provide a keypad.

For such small keypads, an important factor is the ease with which they may be used by a user. A keypad should enable a user to select keys rapidly, in a way
20 that is natural and intuitive and without involving too much unnecessary finger movement.

Keypads for mobile telephones generally have a common, basic, configuration shown in Figure 1. Keys which are used in dialling numbers (and for other purposes) are typically provided in a 4 by 3 matrix having a first row of numerals "1",
25 "2" and "3", a second row of numerals "4", "5" and "6", a third row of numerals "7", "8" and "9" and a fourth row having a first character/function key, numeral "0" and a second character/function key. Another arrangement of keys, which is usually located above this arrangement, is used to carry out other functions such as initiating and terminating telephone calls and navigating around the screen and various menus of a user interface of the mobile telephone.
30

One disadvantage of this arrangement is that there is little natural spatial correspondence between the locations of the keys and the numerals which are selectable. For example, although key 6 is adjacent to one key 5 (as a row neighbour), it is also below key 3 and above key 9 (as two column-neighbours). Therefore, use of such a keypad needs to be learned by a user. For example, it is not unusual for a user to remember the input sequence of a telephone number or a code by remembering the pattern of finger movements which is used in inputting the telephone number or code.

10

To deal with this problem WO 98/24103 and WO 99/48120 propose alternative keypad arrangements for mobile telephones in which numeral keys are disposed in a generally oval configuration.

Another disadvantage of such a keypad is that if it is used in an orientation other than the one originally intended, it becomes more difficult for a user to select the correct keys. For example, if the keypad of Figure 1 is rotated clockwise through 90°, the keys then appear to a user to be in a 3 x 4 matrix and the spatial relationships between keys also appear to have changed. Key 6 now has two row-neighbours, keys 9 and 3 and one column-neighbour, key 5. This is confusing since a user cannot readily apply learned spatial relationships. In addition, any text associated with the keys will also have rotated and will be more difficult to read.

20

The keypad arrangements of WO98/24103 and WO 99/48120 are difficult to use if the mobile telephone is used in such an alternative orientation.

25

SUMMARY

According to the invention there is provided an electrical device having a body, a display, and a keypad in which the keypad is rotatable with respect to the body.

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In this way it is possible for the orientation of the display to be changed with respect to the body whilst the body is rotated about the keypad. This may be used to maintain a particular orientational relationship between the keypad and the display. This may be useful in allowing the mobile terminal to be used in different orientations.

Preferably the keypad has a plurality of individual numeral keys assigned to individual numerals. Preferably the keypad has a navigation key for navigating about the display. The numeral keys assigned to individual numerals may be disposed about the navigation key.

Preferably the display has a non-unity aspect ratio.

Preferably the numeral keys are disposed in a circular pattern about the navigation key. All of the numeral keys may be disposed about the navigation key. In an embodiment in which the keypad is circular, it may be rotated particularly conveniently.

The keypad may be rotated by a user to optimise the electrical device for both horizontal and vertical viewing modes. It is particularly convenient in providing ready right- and left-handed useability. In this way it is possible for a user to change use of such a display from a portrait mode to a landscape mode whilst maintaining the orientation of the keypad.

Preferably the keypad is rotatable by hand. Alternatively it is driven by an electrical motor.

Preferably the keypad is removeable. It may be "rotated" by being removed from the electrical device and then being replaced in a different configuration. According to the invention both the orientation of the keys and the orientation of the display may be changed so that they maintain a correspondence.

Preferably the navigation key may be used, among other things, to control movement of a cursor in the display or to move a selection highlighter through menus in the display. The term "navigation key" refers to any suitable manually operable
5 input receiving means and includes such things as joysticks, rollers and the like.

Preferably the numeral keys are arranged in an annulus. The annulus may comprise a single integrated piece or it may be a plurality of separate pieces. In the latter case, a separate piece is assigned to each of the numeral keys. Separate
10 pieces may be able to move relatively to each other, for example when there is a key-press for a particular key.

Preferably the annulus is rotatable. The navigation key may also be rotatable. Preferably the annulus and the navigation key are keyed together so that they rotate together.
15

Preferably the keypad comprises a keymat defining the plurality of keys and a corresponding plurality of pressure sensitive areas which detect key presses and produce corresponding electrical signals.
20

Preferably the electrical device is a wireless communications device. It may be a mobile terminal such as a mobile telephone.

In an embodiment in which the keys are circularly disposed in numerical order, their positions and their sequence have a logical correspondence. This can provide a convenient keypad in which location of the keys is straightforward.
25

Although reference is made to key-presses and pressing of keys, it is to be understood that an electrical device according to the invention may receive input by a means other than the pressing of keys.
30

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

5 Figure 1 shows a prior art keypad.

Figure 2 shows a mobile terminal according to an embodiment of the invention.

Figure 3 shows detail of the keypad of Figure 2.

Figure 4 shows the mobile terminal of Figure 2 in one orientation.

Figure 5 shows the mobile terminal of Figure 2 in another orientation.

10

DETAILED DESCRIPTION

Figure 2 shows an embodiment of a mobile terminal 50 according to the invention comprising a body 52, a display 54, a keypad 56, an on/off button 58, an ear-
15 phone 60 and a microphone 62. The display 54 has a non-unity aspect ratio.

The keypad 56 comprises a keymat comprising a plurality of keys located above a pressure sensitive part. The pressure sensitive part has a plurality of pressure sensitive areas which detect key presses and produce corresponding electrical
20 signals. An individual key comprises a part of the keymat and its corresponding pressure sensitive area on the pressure sensitive part.

Individual keys are dedicated to the operation of the terminal 50 and include keys to initiate and terminate calls, 64 and 66 respectively, an asterisk key 68 and a
25 hash key 70. The keypad 56 comprises a set of numerical keys disposed in a circular arrangement around a centrally located navigation key 72.

In this embodiment, the numeral keys 1 to 9 and 0 are provided adjacent to one another in a circular arrangement such that neighbouring numeral keys are in nu-
30 merical order. In this embodiment key 0 is located between keys 9 and 1. The asterisk key 68 and the hash key 70 are located outside the circular arrangement

although in another embodiment, they could be located inside the circular arrangement or indeed as part of the circular arrangement. In this latter case, one preferred arrangement is for the sequence of keys to be arranged in locations corresponding to a clock face in which keys 1 to 9 have locations corresponding to clock face numerals 1 to 9, key 0 has a location corresponding to clock face numeral 10, the asterisk key has a location corresponding to clock face numeral 11 and the hash key has a location corresponding to clock face numeral 12. In another embodiment, the numeral keys are not disposed about a navigation key.

10 The numeral keys are disposed in the form of an annulus surrounding the navigation key 72. The annulus is segmented into separate pieces each of which can be individually pressed without necessarily causing pressing of any other part of the annulus.

15 The keys are not only used for numerical input but they are also used to input alphabetical and other characters. For example, the key 2 typically has an alphabet of characters 2, a, b and c. Although other characters may be selectable, for example equivalents of these characters for various languages, only these four characters will be considered for the sake of simplicity. In normal telephone mode
20 of the mobile terminal 50, pressing key 2 selects numeral 2. In other modes, for example in writing short message service (SMS) messages, letter a is selected by a single key-press of this key, letter b is selected by a double keypress of this key, letter c is selected by a triple key-press of this key and so on. Other letters of the alphabet are present on others of the keys. The key 1 also has a set of punctuation marks assigned to it. The alphabetical characters and punctuation marks, as
25 well as the numerical characters, can be used in the writing of text, for example, SMS messages.

The keymat of the keypad 56 is configured to rotate with respect to the body 52.
30 The mobile terminal 50 comprises angular orientation measurement means which can measure the angular orientation of the keymat with respect to the body and

change the mapping of the keymat to the corresponding pressure sensitive areas so that pressing a particular key produces an electrical signal, which is understood by the mobile terminal 50 as being associated with that key. An advantage of this is that the angular orientation in which the mobile terminal is used can be
5 changed. Thus, the mobile terminal can be turned on its side whilst still presenting its display 54 to a user and the orientation of the display 54 with respect to the body 52 can be changed to that it is in a different orientation, for example in a landscape orientation rather than in a portrait orientation. It may be convenient to connect the display to the angular orientation measurement means so that an an-
10 gular change of the orientation of the keymat of the keypad 56 additionally causes an angular change in the presentation of an image on the display 54. For example, the keymat of the keypad 56 and the image being displayed could both be rotated by 90°. This could be useful if the display is being used to display an image which is not suitable to the aspect ratio of the display.

15 The mobile terminal 50 is provided with locking means which locks the keymat and the body 52 into a particular orientation. The locking means may lock the keymat and the body 52 so that no relative movement is permitted between them or so that relative movement is only permitted when a sufficiently high rotational
20 force is applied to the keymat.

Allowing the user to rotate the keymat for horizontal or vertical display presentation or for right- or left-handed use provides improved useability of the mobile terminal 50. Furthermore, an interchangeable keymat allows the user to configure
25 the hardware interface of the mobile terminal 50 in a way which is convenient and suitable to their needs and preferences. The keymat 56 and the body 52 may have complementary decorative patterns so that the patterns match when a key and a pressure sensitive area are in registration. Alternatively, the patterns may be such that there are different degrees of matching between the keymat and the
30 body 52 at different angular orientations at which the keys are in registration with the pressure sensitive areas.

- If interchangeable keymats are used, this may provided a suitable way to "rotate" the keymat. The keymat may be removed from the mobile terminal 50 and then be replaced in an alternative configuration. Of course, the mapping between the keys
5 of the keymat and their corresponding pressure sensitive areas would also be changed so that pressing a particular key produces an appropriate electrical signal. Additionally, the orientation of the display 54 may be correspondingly changed so that the keymat and the display 54 are in matching orientations.
- 10 The navigation key 72 can be either self-orientating like the display or it can be part of the keymat that is removed and replaced. If it is self-orientating, it remains in place when the keymat is removed and the mapping between arrow functions of the navigation key and corresponding pressure sensitive areas are changed.
- 15 In another embodiment the annulus is a single integral piece having zones disposed at different angular positions assigned to different numerals. Pressing different zones causes different numerals to be selected and entered into the display.
- 20 Figure 3 shows detail of the keypad 56 of Figure 2. It shows in side view a keymat 80 and a pressure sensitive part 82 located beneath it. The keypad 80 and the navigation key 72 are keyed together against relative rotational movement. For example, they may comprise an integral piece. Both the keymat 80 and the pressure sensitive part 82 have cooperating contact points 84. The body 52 is shown
25 as a fragmentary part. The keymat 80 is connected via an axle 86 to an electric motor 88. The electrical motor 88 is able to drive the keymat relatively to the pressure sensitive part 82 and the body 52.
- 30 The pressure sensitive part 82 and the electrical motor 88 are both connected to, and controlled by, a controller 90 which ensures that, as the keymat 80 is rotated by the electrical motor 88, the mapping of corresponding contact points 84 is

changed accordingly so that pressing a particular numeral key of the keymat still produces the appropriate electrical signal so that the mobile terminal 50 correctly recognises the keypress.

- 5 The effect of rotating the keypad 56 is shown in Figures 4 and 5. The keypad 56 has been rotated 90° clockwise and the orientation of an image presented on the display 54 has been changed correspondingly. Therefore, in relation to Figure 5, a user now uses the mobile terminal 50 (and its user interface) in an orientation in which it extends mostly in a horizontal direction. The two numerals, 0 and 5,
10 shown on the keypad 56 are simply to illustrate its orientation relative to the mobile terminal 50.

In all of the preceding embodiments of the inventions, other arrangements of keys may be used. For example, the keys may be arranged alphabetically according to
15 the alphabetical letters assigned to the keys. In such an alphabetical layout, there may be more than ten keys assigned to alphabetical letters arranged in a circle. The keys may be arranged in a so-called QWERTY layout in which each individual letter is assigned to a corresponding individual key or pluralities of letter are assigned to corresponding individuals keys like in Figure 1 but the sequence of let-
20 ters follows the QWERTY sequence rather than being alphabetical.

Although the foregoing description relates to a mobile terminal such as a mobile telephone, it should be understood that the invention can be applied to other devices such as computers, personal digital assistants and entry terminals for input-
25 ting data or access codes, for example to gain access to a building or to another secure location, for example a bank account.

Particular implementations and embodiments of the invention have been described. It is clear to a person skilled in the art that the invention is not restricted to
30 details of the embodiments presented above, but that it can be implemented in other embodiments using equivalent means without deviating from the character-

istics of the invention. The scope of the invention is only restricted by the attached patent claims.

CLAIMS

1. An electrical (50) having a body (52), a display (54) and a keypad (56) in which the keypad is rotatable with respect to the body.
- 5 2. An electrical (50) according to claim 1 in which the (56) has a plurality of individual numeral keys.
3. An electrical device (50) according to claim 1 or claim 2 in which the keypad has a navigation key (72) for navigating about the display.
- 10 4. An electrical device (50) according to claim 3 in which the numeral keys are disposed about the navigation key (72).
5. An electrical device (50) of claim 3 or claim 4 in which the plurality of individual numeral keys are disposed in a circular pattern about the navigation key (72).
- 15 6. An electrical device (50) according to any preceding claim in which the keypad (56) is rotatable by hand.
- 20 7. An electrical device (50) of any preceding claims in which rotation of the keypad (56) is driven by an electrical motor.
8. An electrical device (50) of any of claims 3 to 7 in which the plurality of individual numeral keys and the navigation key (72) are keyed together so that are rotatable together.
- 25 9. An electrical device (50) of any preceding claims in which the keypad (56) comprises a keymat defining the plurality of individual numeral keys and a corresponding plurality of pressure sensitive areas which detect key presses and produce corresponding electrical signals.
- 30

10. An electrical device (50) according to any preceding claims which comprises a mobile telephone.

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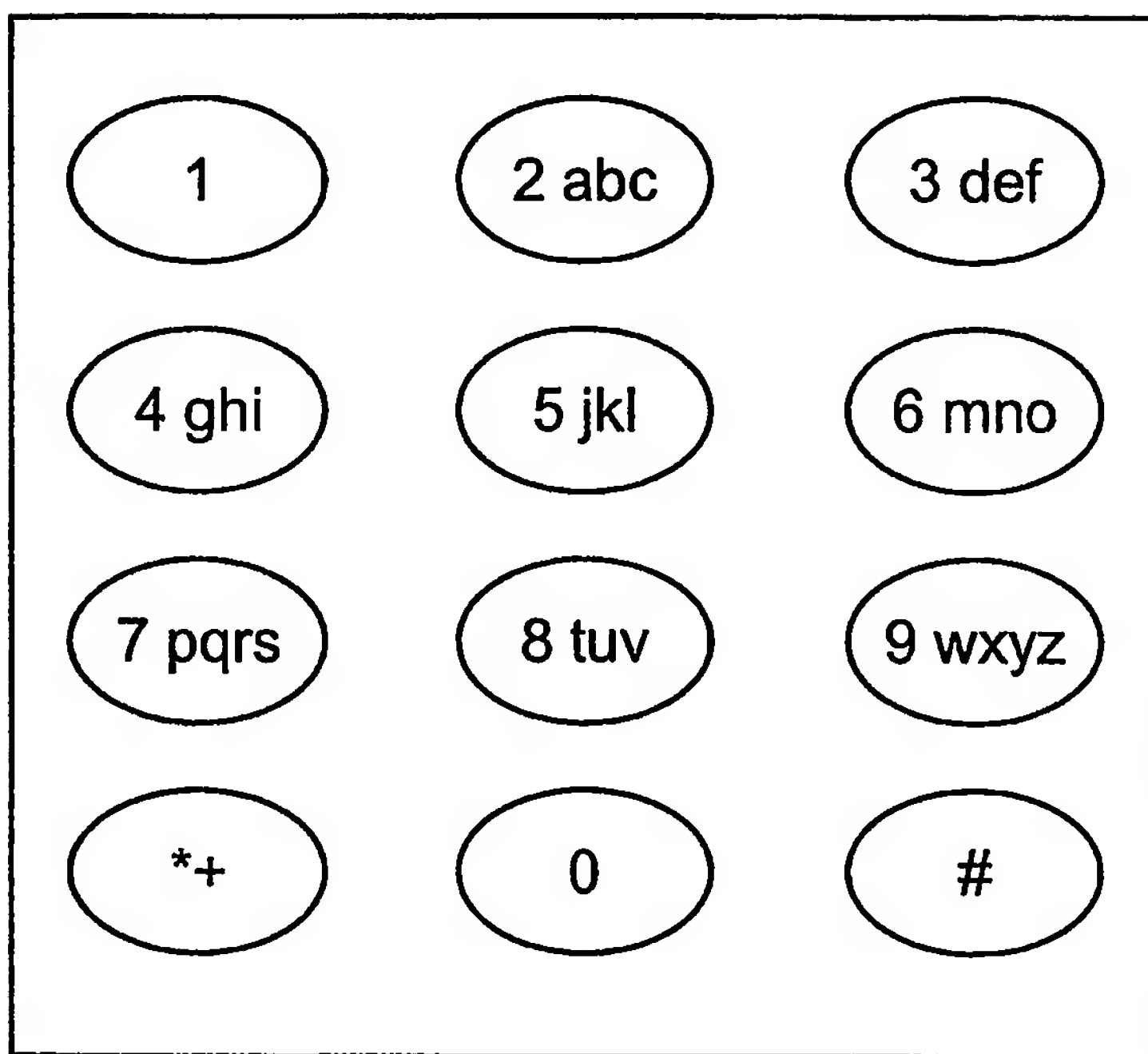


Fig. 1

PRIOR ART

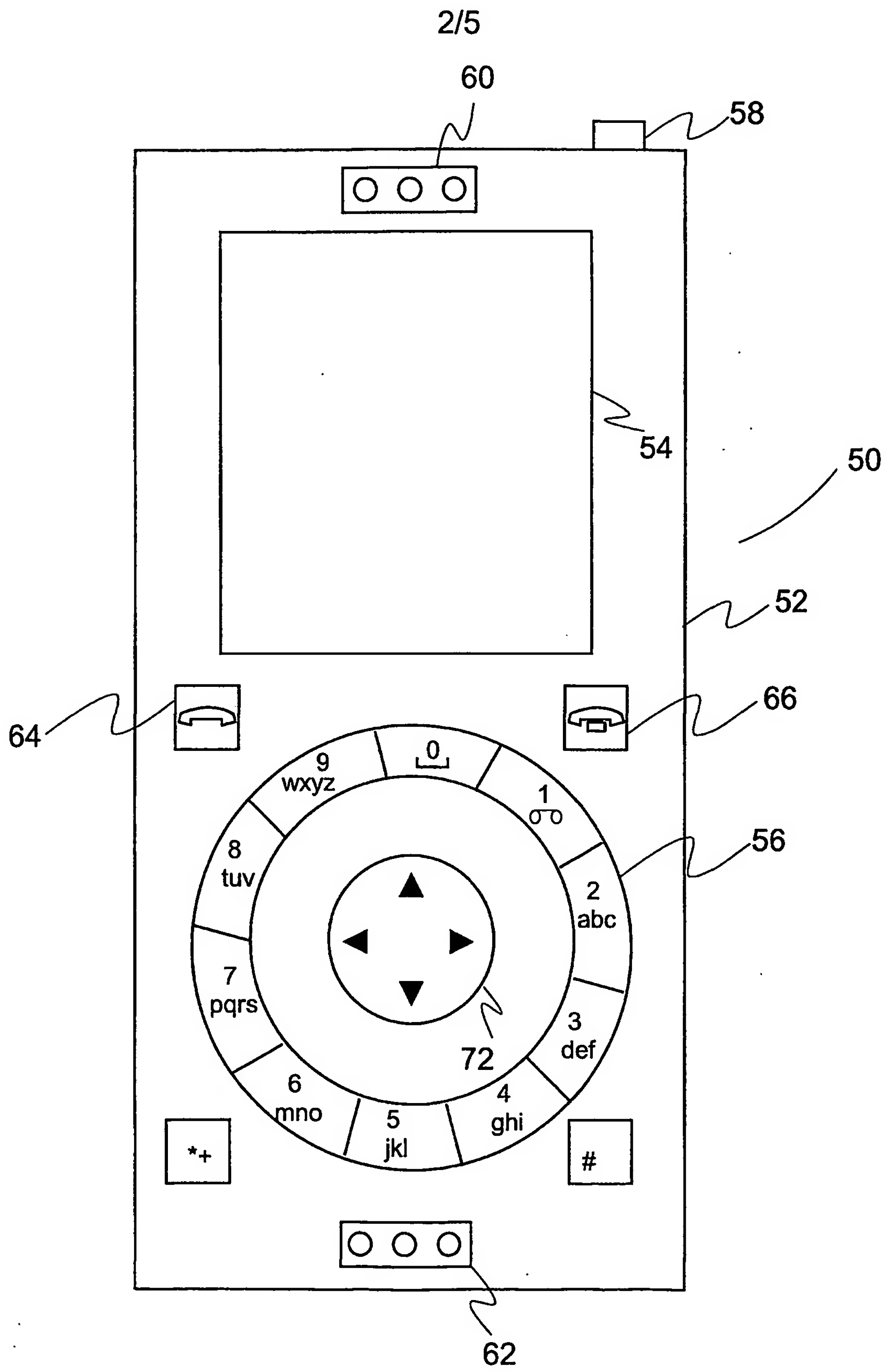


Fig. 2

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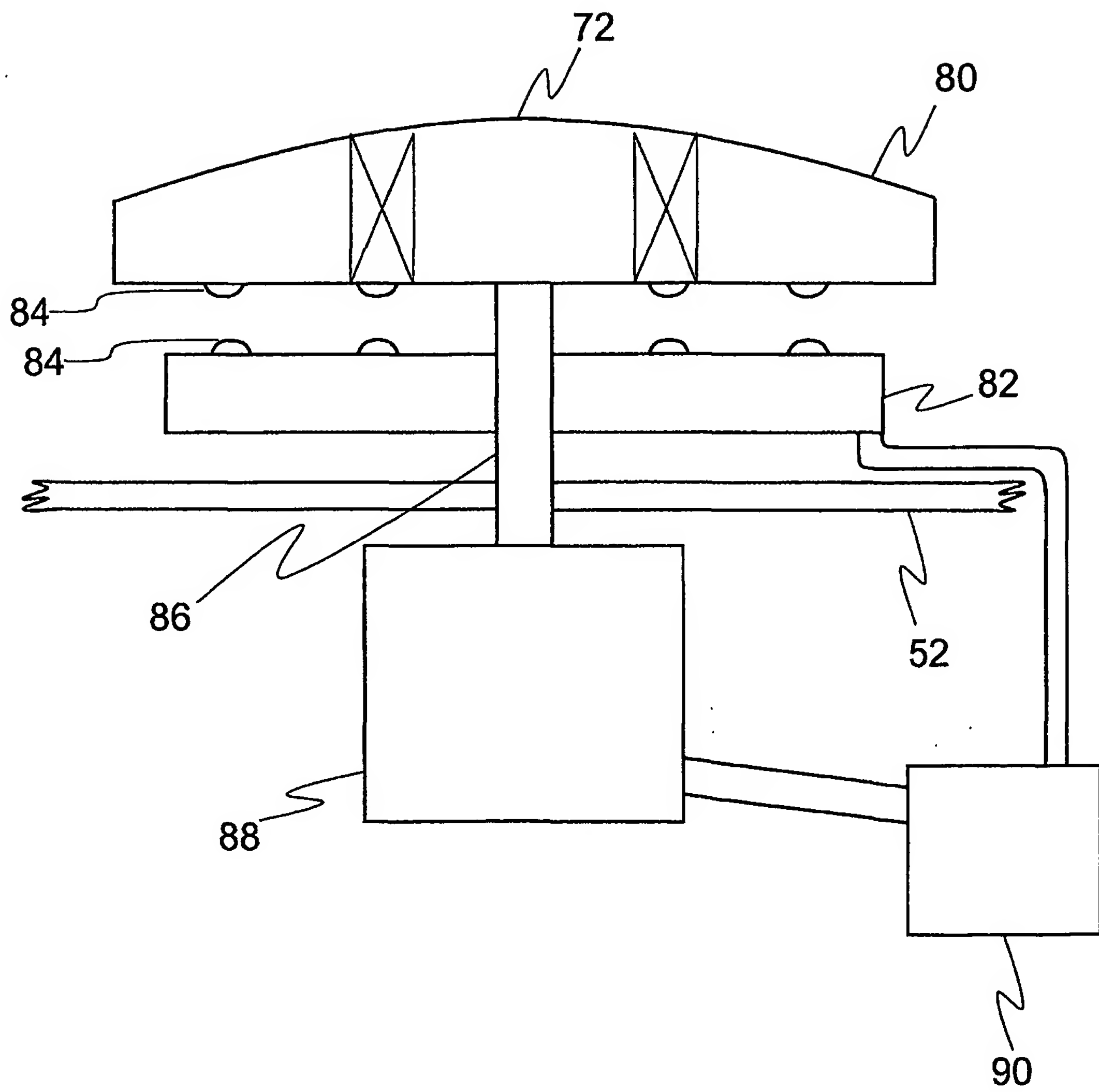


Fig. 3

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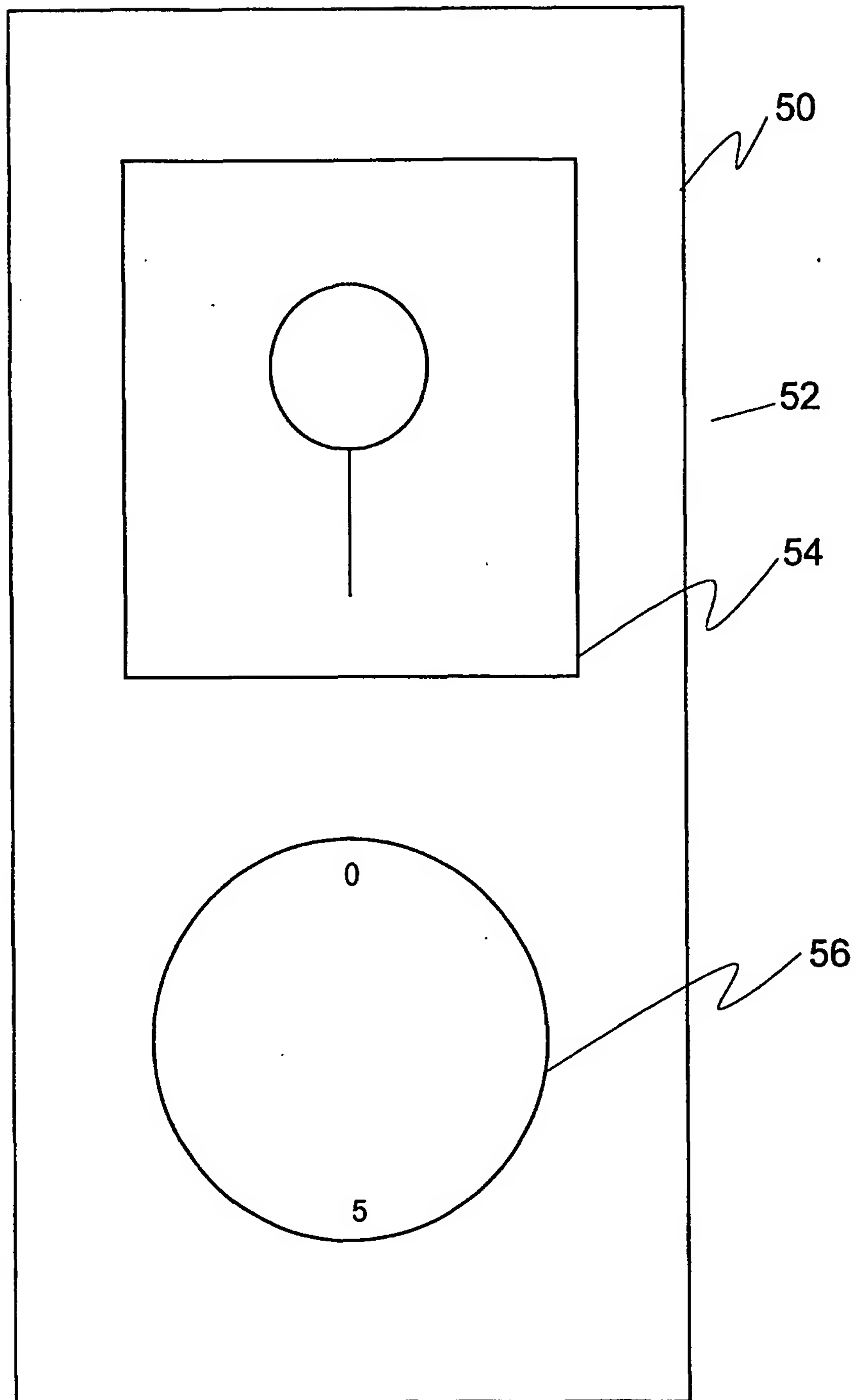


Fig. 4

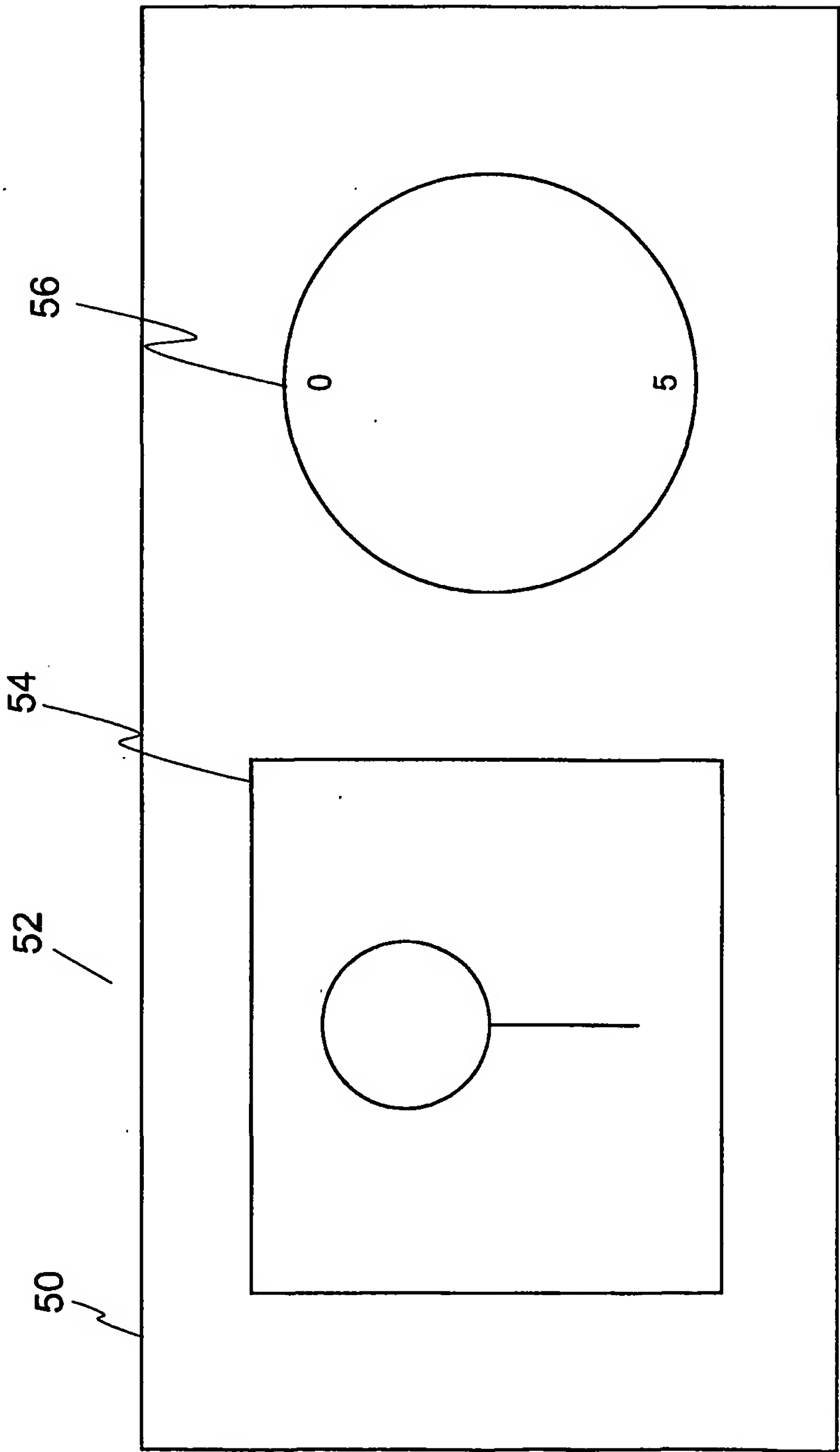


Fig. 5